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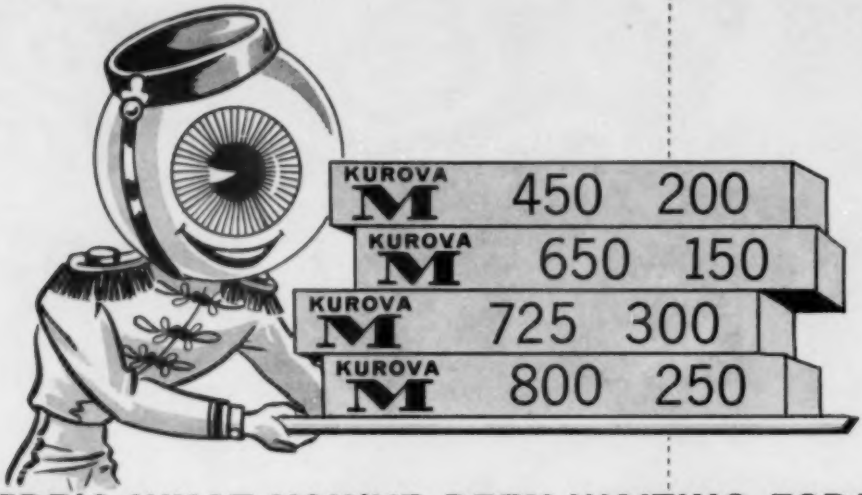

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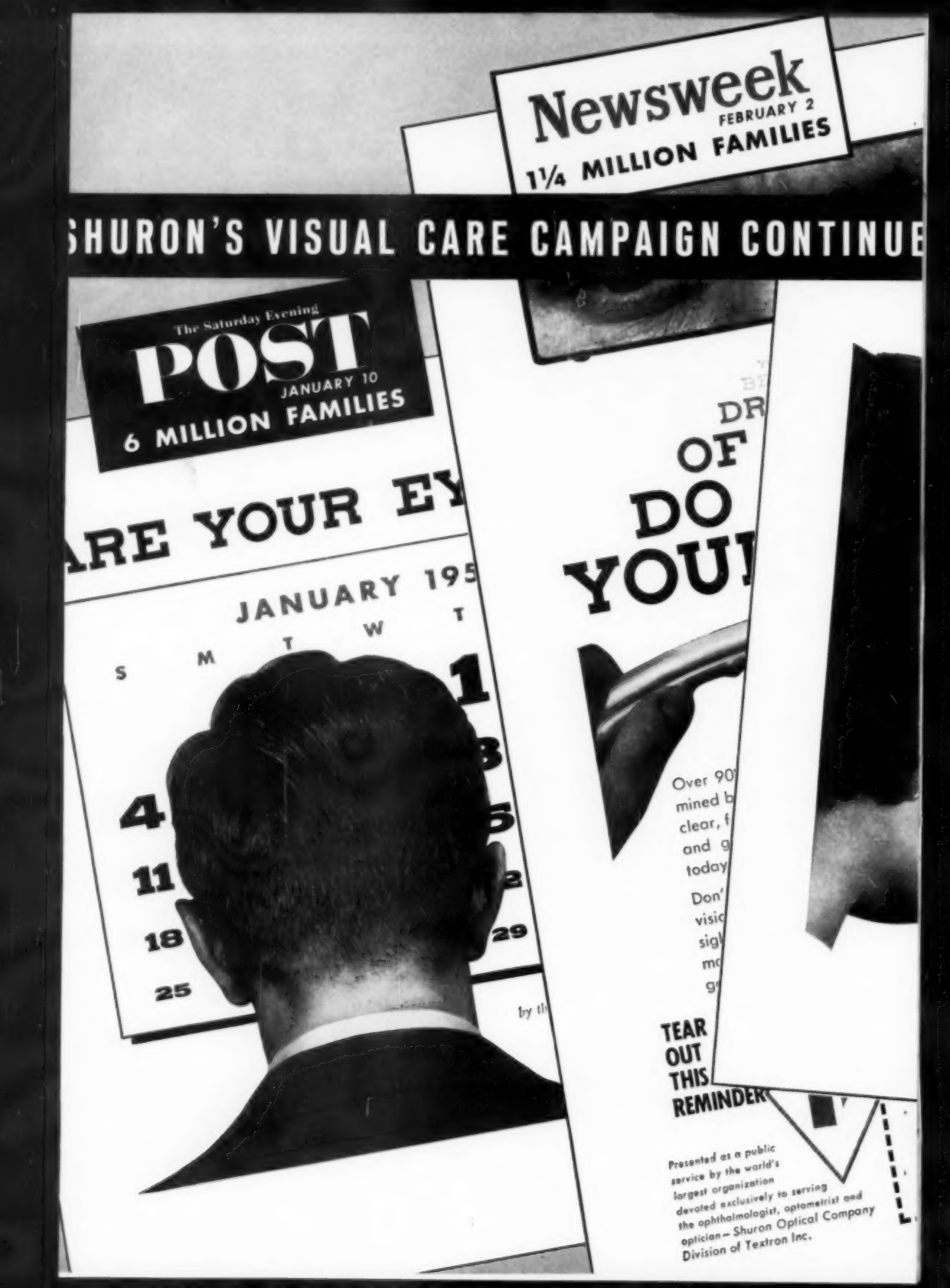
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EYE SIZES	DBL
42	18-20-22
44	18-20-22-24
46	18-20-22-24

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Jet . . . . . JT
Mink . . . . . MI
Golden Beige . . . . GE
Glacier Blue . . . . GL

LENS PATTERN
F66-8

EYE SIZES	DBL
42	18-20-22
44	18-20-22-24
46	18-20-22-24
48	18-20-22-24

TEMPLES JAL71
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ROYAL PRELUDE
RF6857

COLORS
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Glacier Blue . . . . GL
Mink . . . . . MI
Heather Grey . . . HG

LENS PATTERN
F76-11
(Nylon-Salmon)

EYE SIZES	DBL
44	18-20-22
46	18-20-22-24
48	20-22

TEMPLES RF57
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Fitting Values: 4", 4¼", 4½"

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COLORS
Canyon Brown . . CY
Gunmetal . . . . GNM
Silvertone . . . . . SVT

EYE SIZES DBL
44 18-20-22-24
46 18-20-22-24
48 20-22-24

LENS PATTERN
F77-7 (Emerald)

DD129 . . . . . Pink Gold Chassis
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DD126 . . . . . White Gold Chassis

TEMPLES E90
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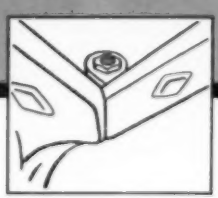

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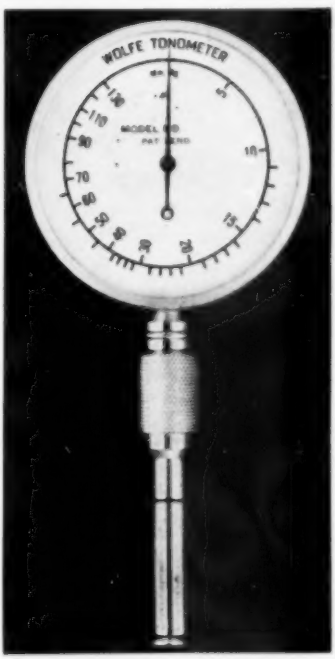

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Vol. 36 March, 1959 No. 3

FURTHER STUDIES ON THE RELATIONSHIP BETWEEN AMBLYOPIA AND THE STILES-CRAWFORD EFFECT*

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Columbus, Ohio

INTRODUCTION

Previously, a preliminary study dealing with the relationship between amblyopia and the orientation of the retinal receptors‡ was presented.[1] In that report, earlier studies were reviewed, a theoretical argument was stated, and one case was described. In this current study, an additional group of five cases is considered, the theoretical position restated and implemented, and a new instrument described.

For the purposes of this discussion, amblyopia will be defined as poor vision not amenable to correction by routine refractive procedures. To those not familiar with the Stiles-Crawford effect,[2] these outstanding investigators were the first to discover the fact that the sensitivity of the retinal receptors varies as a function of the angle of incidence of light at the retina. For such a phenomenon to occur two things are necessary, i.e., some component or components must be directionally differentially sensitive, and the individual components must be aligned with some degree of uniformity. If this is the case, one may ask what occurs if the alignment of that which is oriented is disturbed? This is the subject of this discussion.

If the alignment of the oriented components is disturbed, certain things may be expected to occur. First, if the direction of maximum sensitivity of these components is such that they are not directed at the center of the entrance pupil, less light will be absorbed by these receptors. It is well known that acuity is dependent upon the amount of light absorbed.[3] Secondly, under certain specified stimulus conditions, one would anticipate that these receptors, with their directionally oriented components aligned as in the first instance, would absorb

*Read before the annual meeting of the American Academy of Optometry, Boston, Massachusetts, December 13, 1958. For publication in the March 1959 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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‡or some component of those receptors

greater amounts of stray light.[4] Stray light acts to reduce contrast, which, in turn, affects acuity.

The above two types of disturbance may be independent of total recepter orientation, i.e., the orientation of some component within the cell may be disturbed, as contrasted with the orientation of the cell itself. If the orientation of the receptor cells is disturbed, the above two factors, plus two additional factors should be considered. First, if one can consider the simple case of a single ray of light, incident normally at the retina, this ray might strike a single receptor if the receptors were aligned as if they were soldiers on a drill field (Figure 1). However, if the receptors are oriented at an angle to the incident

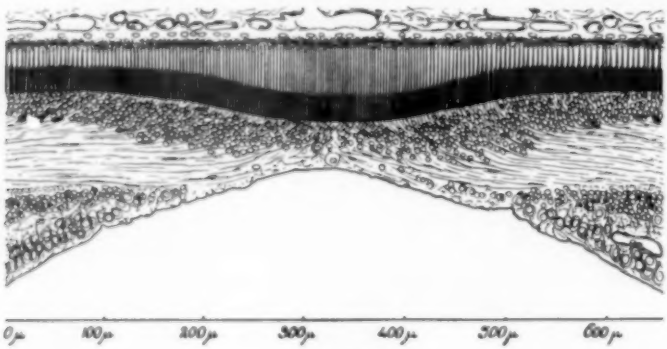


Figure 1.

Fig. 1. The theoretical normal orientation of receptors in the fovea of the normal eye. (Reprinted from *The Retina* by S. L. Polyak by permission of the University of Chicago Press.)

ray, it would very probably pass through more than one receptor (Figure 2). The effect of this is obviously to reduce the "grain." In other words the resolution of a receptor system is dependent upon the area covered by each of the individual elements. Therefore oblique incidence, or oblique orientation precludes fine resolution. It also follows that if all fibers were uniformly tilted, acuity would vary as a function of the meridian tested.

A second consideration of receptor tilt was revealed as part of a recent study* of a model retinal receptor studied at microwave frequencies.[5] One of the experiments conducted in that program was a qualitative one to determine the number of receptor elements needed

*This phase of the program was sponsored by a contract between the Air Force Office of Scientific Research and the Ohio State University Research Foundation (Contract No. AF 18 (603-63)).

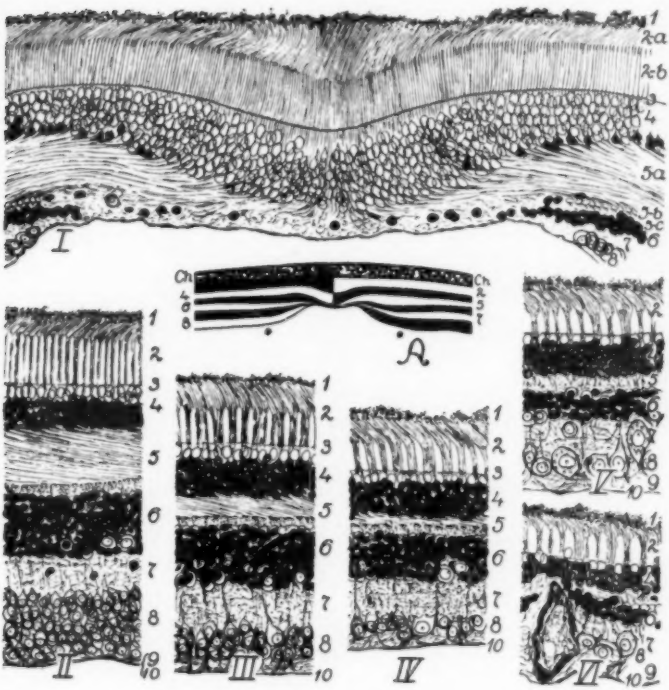


Figure 2.

Fig. 2. Schematic drawing of the appearance of the receptors on microscope slides. One can conceive that such distributions might occur *in vivo*. (Reprinted from *The Retina* by S. L. Polyak by permission of the University of Chicago Press.)

in the experiment. Without going into considerable detail in regard to the problem, in previous work of this type[6] the test model was surrounded with six duplicate models in order to simulate retinal receptor packing.

The models employed (Figure 3) were only of the ellipsoid portion of the receptor cells. It was found that if the axes (center lines) of the models were parallel, i.e., angle $\beta = 0°$ there was *little interaction* between receptor elements for virtually all angles of incidence of the radiant energy. The axes of the receptors were rotated to the optic axis of the microwave system, and were placed at various positions and planes in the diffraction pattern. This finding implies relative independence or integrity of the energy path *once the energy enters the*

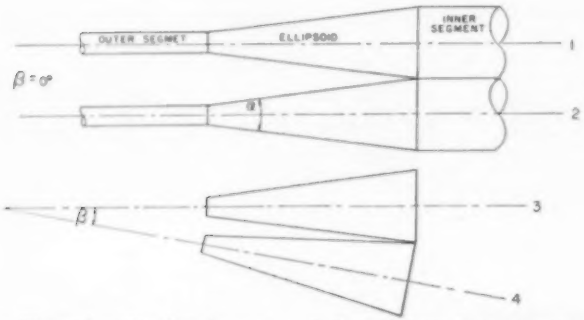


Fig. 3. Illustration showing the nature of the experimental arrangement in the microwave study.

ellipsoid. This finding is important in terms of our understanding the mechanisms subserving visual acuity in the retina. The maximum change in recorded power absorbed due to the presence of an additional receptor was 0.2 log unit.

However, if angle β was not equal to zero, the interaction between elements increased (note β maximum is equal to α). This interaction seemed greatest when $\beta = \alpha$ or when the surfaces were parallel. For this to occur, the surfaces did not have to be in contact, rather, merely contiguous to each other. If separated by about two wavelengths or less this phenomenon was noted. Interactions up to about 1.0 log unit were found. In other words, if the outer segments or ellipsoids of neighboring receptors come into close relationship with each other, the energy within the receptors interacts to a considerable degree causing a loss in the integrity of the individual light paths, and hence, in visual resolution. These interaction phenomena are also known as frustrated total reflection. Recent work in the field of fiber optics[7, 8, 9] tends to support these findings.

Thus, four mechanisms are suggested which would tend to reduce acuity, if that which is oriented in the fovea is disturbed. On the basis of these theoretical arguments, therefore, one may hypothesize that a certain percentage of individuals with amblyopia due to either physiological or pathological causes would be expected to have non-customary directional sensitivity patterns as regards form or orientation.

APPARATUS AND PROCEDURE

The instrument previously available[1] for testing directional sensitivity of the retina required considerable skill on the part of the subject. Testing was accomplished by completing a match between the two halves of a bipartite field. Although seemingly a simple judgment, one

runs into many problems with this type of response in this type of testing due to spherical aberration of the eye, perceived shifts in hue of test beam, and the accuracy of the judgments of non-trained subjects.

In view of these problems and the fact that the previous instrument only provided information as to relative differences (rather than absolute differences) in directional sensitivity, the decision was made to build an instrument utilizing a contrast ($\Delta B/B$) threshold method for determination of retinal directional sensitivity. The point concerning absolute versus relative measurement of differences is of importance, because in one of the theoretical statements made above, it was stated that sensitivity would be changed by changes in component orientation. The new instrument can be employed at any given adaptation level to obtain retinal directional sensitivity data using a brightness difference contrast threshold technique.

In addition to these changes in technique, additional devices guaranteeing improved centration and fixation have been included.

A description of the instrument (Figure 4) follows. Light from a continuously monitored D.C. source, S1, is collimated by lens L1 after passing through a piece of heat absorbing glass, H. A 6 volt, 18 ampere, ribbon filament lamp is employed at S1. The light passes through an interference filter, F1, after being collimated and is then divided into two paths by a beam splitter. If one chooses the path continuing straight ahead, the light then passes through a neutral density filter, F2, which is employed to adjust the range of test luminances employed. Moveable aperture A1 is at the focal point of lens L2 and is conjugate with the plane of the entrance pupil of the eye and (as will be discussed below) ground glass GG1. By moving aperture A1 laterally, and up and down in the collimated beam, light may be

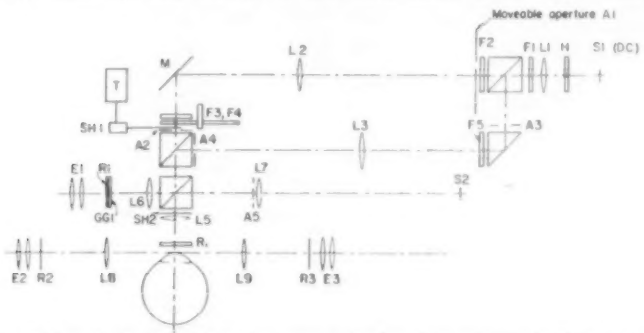


Fig. 4. Schematic drawing of the instrument developed to measure the Stiles-Crawford effect using a contrast threshold method.

directed into any part of the entrance pupil of the eye allowing measurement of the Stiles-Crawford effect.[2] Lens L2 focuses the beam of light at aperture A2. This aperture is at the focal point of lens L5 and hence the beam after passing through lens L5 is imaged at infinity. In the case of the emmetropic eye, aperture A2 is conjugate with the retina. After passing through lens L2 the beam is reflected at mirror M and passes through an adjustable balanced neutral density wedge F3, F4 and a timer (T) controlled shutter, SH1, which allows a brief presentation of this component of the stimulus pattern every twenty seconds.

Returning to the beam splitter placed after lens L1 and filter F1, the beam reflected at 90° passes through aperture A3 (conjugate to the entrance pupil of the eye) a reflecting prism and a neutral density filter F5. This beam acts as a uniform surround field upon which the test beam discussed above is superimposed at desired intervals. Filter F5 adjusts the adapting level of the eye being tested. Apertures A3 and A4 are at the focal points of lens L3. Lens L3 focuses the light beam at aperture A4. After being reflected in the beam splitter the light follows the same path as the beam from aperture A2. Aperture A4 is at the focal point of lens L5. Aperture A4, the adapting field, subtended 1.87° of arc at the eye, and aperture A2, the test field subtended 0.58° of arc at the eye. The area of the image of A3 in the entrance pupil is 0.28 mm.^{2} (centered) and the area of the test beam in the entrance pupil is 0.06 mm.^{2}

Point source S2 is imaged by lens L7 near shutter SH2. This part of the instrument is a device guaranteeing centration of the entrance pupil of the eye. Aperture A5 allows an annular beam of light to pass. This annular beam diverges from its point of focus in front of the eye. The inner radius of the annulus is small enough to pass through the dilated pupil, however, the outer radius of the annulus is much larger than the entrance pupil of the eye. Hence the edge of the iris forms the outer border of the annulus seen by the eye. The subject continually adjusts himself in order to maintain the centration of the iris border and inner border of the annulus. Note, that this device also acts to control fixation, and is maintained at the same luminance level as the adapting field. White light was employed. The test and adapting fields fall concentrically within the inner border of the centration device. A polarizing ringsight, Ri, may be used to further guarantee centration (not employed in this series). This is a calcite crystal sandwiched between polaroids which provides an annular interference pattern. This may be lined up with the inner ring of the shadow image of aperture A5

or with the outer border of the adapting field. Devices such as these, make possible continuous alignment of the adapting field, the test field, the center of the entrance pupil of the eye and the fovea. This is a most important consideration in testing of this type. The subject is held firmly during the test period by a bite plate and head rest. Two microscopes with reticules flank the head to allow anterior-posterior positioning of the subject. (E2, R2, L8, L9, R3, E3.)

In order to ascertain where the test beam enters the entrance pupil of the eye, to measure entrance pupil size, and to assure centration of the adaptation field and the annular beam, a monitoring device is employed. On the ground glass GG1 the pattern, as formed in the entrance pupil of the eye, is reproduced. A measuring reticule, R1, is viewed through an eyepiece, E1. Pupil size is measured and centration checked by traversing the image of aperture A1 across the entrance pupil and measuring points of disappearance of that beam. Shutter SH2 is placed in the beams to allow adjustment of the instrument without the subject viewing the display.

During the measurements, an ascending method of limits was employed. Two consecutive positive responses were employed as the criterion for threshold. The stimulus was increased in luminance by 0.02 log units each presentation. The adaptation level employed was 1.803 foot Lamberts, the duration of exposure of the test stimulus was 45.7 milliseconds, and the wavelength of light used was 556 millimicrons. The duration of exposure of the test stimulus was within the critical duration, and the luminance level of the adapting field was in the photopic range.

All subjects were refracted and tests for central fixation administered (after-image tests, location of blind spot test, corneal reflex test). The pupils were dilated with paradrene hybrobromide, 1% ophthalmic solution.[1] Testing was not initiated until cone dark adaptation was complete. Each single set of data was obtained at a separate three hour session. To prevent bias, the direction of the sweep across the pupil was reversed at each sitting. Three hour training sessions were given each subject prior to the initial collection of data.

Experimental subjects were carefully selected. Non-squinting amblyopes having good monocular central fixation and impairment in one eye only were chosen. An acuity of 20/60 was the greatest visual loss considered in order to avoid fixation problems as much as possible.

Table 1 provides refractive and acuity data as regards the several subjects. In all cases, with the exception of subject F.H. the condition has existed for a long period of time. Subject F.H. has noticed that

TABLE 1

TEST DATA OF THE SUBJECTS EMPLOYED

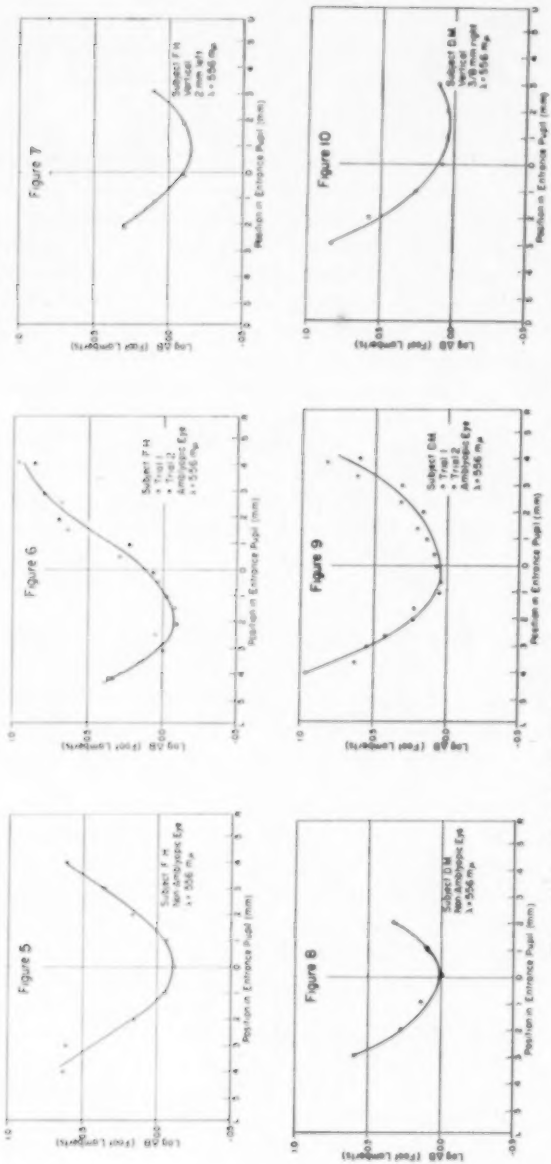
Subject	Eye	Corrected V.A.	Refraction	Age	Directional Sensitivity	Direction of Maximum Sensitivity Horiz.	Vert.
F.H.	O.D.	20/25	—1.25 = —0.25 × 105	35	Simple tilt	5.00° L	2.50° U
	O.S.	20/15	—1.50 = 0		Normal	0	0
D.M.	O.D.	20/20	—2.50 = —0.75 × 15	27	Normal	0	0
	O.S.	20/30—	—1.50 = 0		Simple tilt	1.25° L	3.75° U
D.S.	O.D.	20/60	+2.00 = 0	11	General Malorientation	A	A
	O.S.	20/15	+0.50 = 0		Normal	0	0
R.W.	O.D.	20/60	—2.25 = —0.75 × 175	19	Simple tilt + Reduced Sensitivity	5.00° L	2.00° D
	O.S.	20/20	+1.25 = 0		Normal	1.25° L	1.25° U
C.M.	O.D.	20/20	+0.25 = —0.25 × 5	25	Normal	1.25° L	1.25° D
	O.S.	20/40	+0.25 = —0.25 × 20		Normal	2.50° R	0
T.G. *	O.D.	20/40—	—4.50 = —3.75 × 175	33	General Malorientation	A	X
	O.S.	20/20	—3.75 = —3.25 × 169		Normal	1.25° R	X

A Not applicable
X No measurement
0 Zero
* Recorded in previous study[1]

Note: 1 mm in Entrance pupil = 2.50° change in angle of incidence at the retina.

vision in his right eye has been slowly deteriorating over the past few years. Subject R.W. exhibits a small degree of esotropia and tends to suppress his amblyopic eye in binocular visual tasks, but monocular fixation was normal. Note, all testing in this study was monocular. Subject C.M. tended to suppress his amblyopic eye during binocular tasks. It is interesting to note, that this subject reported that the adapting field tended to disappear during testing of his amblyopic eye if he didn't blink regularly. This offered no real problem during the experimentation. Subject D.M. showed a tendency toward somewhat high esophoria at the twenty foot testing distance, but his fusional reserves proved more than adequate to handle the demand. Subject D.S. tended to suppress his right eye during duction tests and tended to fixate slightly eccentrically during binocular viewing tasks (2ΔB.O.). However, he gave no evidence of eccentric or unsteady fixation during monocular testing. Subject D.S. had had training to improve the acuity in his right eye. His initial acuity had been 20/200, but had improved to the 20/60 shown in the table. At this point no further acuity improvement was obtained by training. All other findings on the subjects were within normal tolerances. None of the subjects reported metamorphopsia.

Attention will now be turned to the data of specific interest in this study. Three sets of data are presented for each subject. A directional sensitivity curve in the horizontal meridian of both the normal and amblyopic eyes, and a vertical directional sensitivity curve in the amblyopic eye *only* with its center through the point of maximum sensitivity in the horizontal meridian. Similar data were of course obtained in the vertical meridian in the normal eye, but since they contribute little to the discussion they have been omitted. However, the position of the point of maximum sensitivity for those data appears on Table 1. The location of the point of maximum sensitivity for the eye may be approximated and located relative to the center of the entrance pupil by simply obtaining the hypotenuse to the right triangle formed by the two components presented in Table 1 for each eye. In cases of general malorientation of receptors such an approach has little meaning as is indicated below. The data for the amblyopic eye of each subject were replicated at least once to determine the reliability of the subject as an observer. It might be noted that patient reliability was remarkably good considering the limited experience each had with testing. In the normal eye, data were replicated if there was any question as to the nature of the distribution. These procedures required well over twenty hours of each patient's time, part of which was compensated. Obviously,



Figs. 5-19. Foveal threshold determinations for light entering different points in the entrance pupil of the eye.

this is hardly a clinical procedure in its present form. This investigator is actively seeking ways and means of markedly reducing the time factor in this testing. A report on this phase of the problem will be presented shortly.

Figures 5-19 represent the data. The ordinate represents the just noticeable difference (contrast, or Δ B) threshold for the appearance of the test field. The abscissa represents distance in the entrance pupil of the eye from the center of the entrance pupil. The curves appear differently from the ordinary plot of Stiles-Crawford type data in that they are threshold curves rather than their inverse, sensitivity curves. An estimate of the differential sensitivity in the two eyes is obtained by comparing the threshold values at $r = o$. Obviously, it would be necessary to integrate to get a more accurate estimate for a given size entrance pupil. In so doing, one must use care in interpretation. Since, in certain instances, the amblyopic eye absorbs less light from the constant adapting field than the normal eye, its steady state adaptation is different from that in the non-amblyopic eye. Thus Δ B in the amblyopic eye will be somewhat less than it might have been had the two steady states been equal. Obviously therefore, if Δ B values were determined, when the steady states were equal as in the case of absolute threshold, a different Δ B ratio would be expected between the two eyes if all other factors remained constant (which is apparently not the case[10]).

These data therefore present an estimate of the orientation of that which is oriented, and an estimate of the differential sensitivity of the two eyes. A third estimate, that of the relative sensitivity of the two retinas (if the orientation of that which is oriented were not disturbed) is possible by noting the ratio of Δ B values in the two eyes at the points of maximum sensitivity.

Studying these data, one finds that the directional sensitivity patterns in the amblyopic eyes of four of the five subjects (and five of six, if one includes the previously reported case[1]) are not as well oriented toward the center of the entrance pupil as are the patterns in the normal eyes. Frankly, this investigator is amazed at the high proportion of the total group (admittedly small) showing these changes in orientation. Undoubtedly, this is, in part, related to the criteria employed in the selection of patients. However, once selected, no patient was rejected. Notwithstanding, one must use caution in interpreting these results, for it is necessary to determine what proportion of the acuity loss is due to these factors.

The patients tend to show three types of manifestation, simple tilt, general malorientation, and reduced sensitivity independent of

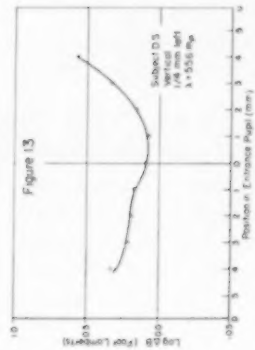


Figure 13
Subject D.S
Vertical
1/4 mm left
λ = 556 mμ
Log 0.8 (Foot Lamberts)
Position in Entrance Pupil (mm)

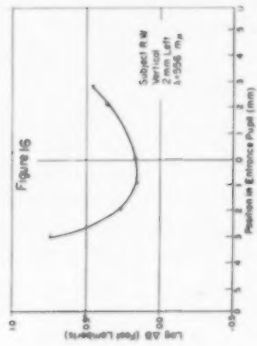


Figure 16
Subject R.W
Vertical
2 mm Left
λ = 556 mμ
Log 0.8 (Foot Lamberts)
Position in Entrance Pupil (mm)

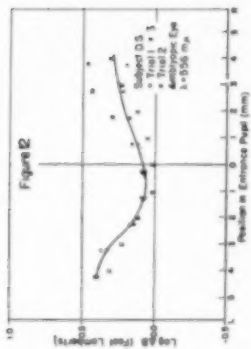


Figure 12
Subject D.S
• Trial 1 + 3
• Trial 2
Amblyopic Eye
λ = 556 mμ
Log 0.8 (Foot Lamberts)
Position in Entrance Pupil (mm)

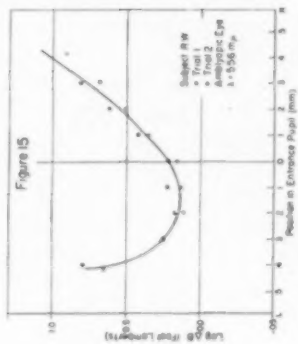


Figure 15
Subject R.W
• Trial 1
• Trial 2
Amblyopic Eye
λ = 556 mμ
Log 0.8 (Foot Lamberts)
Position in Entrance Pupil (mm)

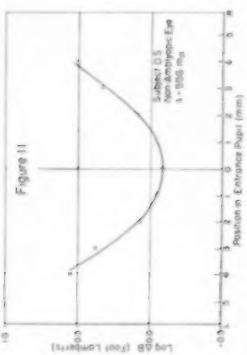


Figure 11
Subject D.S
non-Amblyopic Eye
λ = 556 mμ
Log 0.8 (Foot Lamberts)
Position in Entrance Pupil (mm)

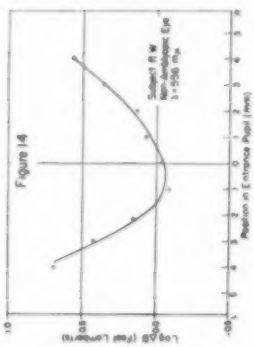


Figure 14
Subject R.W
Non-Amblyopic Eye
λ = 556 mμ
Log 0.8 (Foot Lamberts)
Position in Entrance Pupil (mm)

orientation. In addition, as was noted, one subject showed neither change in orientation, nor sensitivity. These will be reviewed separately below.

SIMPLE TILT

Subjects F.H. (Figures 5, 6, 7) and D.M. (Figures 8, 9, 10) manifest what might be termed a simple tilt. Their direction of maximum sensitivity is obviously displaced, subject F.H. in both the horizontal and vertical meridians, and subject D.M. largely in the vertical meridian. In both subjects at r = o the amblyopic eye is less sensitive than the normal eye, and in both instances peak sensitivity is approximately the same in both eyes. While one can say with some feeling of confidence that the visual loss sustained by subject F.H. (Table 1) may be explained in terms of these findings, the explanation of the visual loss of subject D.M. on this basis remains somewhat questionable.

Obviously the best way to resolve this type of question at this point in the development of the theoretical argument is through a statistical approach. One may study the directional sensitivity characteristics of the normal eyes in this series (insuring constancy of test method), herein defined as eyes manifesting corrected visual acuity of 20/20 or better. If one further states that a left or a right, and an up or a down deviation is equally probable (which may not necessarily be true when one studies the dynamics of the situation), and that deviations from zero are normally distributed with equal variance, it is possible to determine the standard error of the sample for a given direction (see Table 2). If one assumes that abnormality exists beyond three standard

TABLE 2

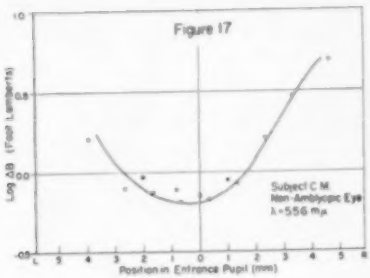
DIRECTION OF MAXIMUM SENSITIVITY—NORMAL EYES

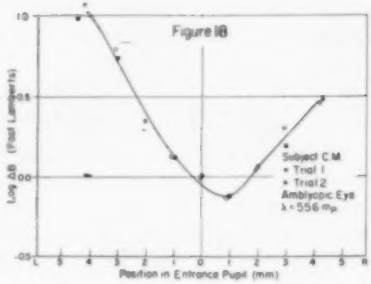
	Horizontal Meridian	Vertical Meridian	Hypotenuse
Mean (*a priori* assumption)	0.00°	0.00°	0.00°
Standard Deviation	0.88°	0.79°	0.88°
Mean + 3 Standard Deviations	2.64°	2.37°	2.64°*

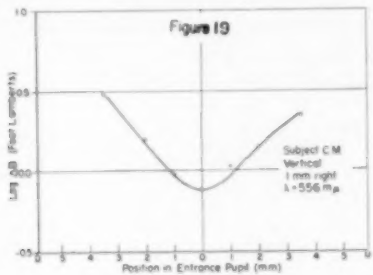
*For Bivariate Distribution, 3.03 standard deviations = 99 per cent of the population.

errors from the mean, then without a doubt subject F.H. shows abnormal orientation. Subject D.M. falls also in the abnormal range, but considering the size of the sample, one would be hesitant to take too rigorous a stand on this matter. Visual acuity measurements determined in the direction of maximum sensitivity would provide a superior estimate.

Subject R.W. (Figures 14, 15, 16) also shows simple tilt but his case will be considered below in a separate category. His tilt is also in the abnormal range as defined above.







GENERAL MALORIENTATION

Subject D.S. (Figures 11, 12, 13) manifests what might be called general malorientation of that which is oriented. This may be a more extreme case of the simple tilt classification, or may be an entity in its own right. The case previously reported[1] would be classified in this category (Table 1). The pattern appears flattened, the amblyopic eye is less sensitive to light, i.e., at $r = o$, the sensitivity of the amblyopic eye is less than that in the normal eye and the retina itself is less sensitive as determined by comparing sensitivities at the points of maximum sensitivity. If the orientation of the receptors is not uniform, one would expect something of this sort to occur, including the decrease in retinal sensitivity.

It has been suggested by many individuals that perhaps in these cases, the central fovea contains rods, or the cones are acting as rods, or vice versa, because of the fact that the rods present a flat pattern in usual Stiles-Crawford type measurements. While almost anything might occur, this author is not quite able to accept this approach. Although many arguments may be offered against reasoning of this type, e.g., actual shape of the functions, threshold values, color vision, etc., another argument may be effectively employed. A highly trained patient

was tested who had active central serous retinopathy. Edema in the macula region was evident, and the patient's acuity had dropped to 20/60 at the time of testing from a normal 20/20. She showed an even more marked general malorientation pattern, i.e., flatter pattern, than either T.G.[1] or D.S. Her fixation was good, but she did manifest some metamorphopsia. This case will be presented separately as part of a discussion of the application of this approach to pathology. While no pattern was obtained previous to her pathology, one does not have the right to assume that prior to her pathological episode she showed general malorientation. This statement is based upon the facts that her vision was originally normal, and that no patterns of this type have been previously recorded on individuals with normal vision. Thus, if one can assume that the pathology induced this change, one can say, such a pattern can be produced if the orientation of foveal cones is disturbed.

REDUCED SENSITIVITY INDEPENDENT OF ORIENTATION CHANGES

Subject R.W. (Figures 14, 15, 16) shows a simple tilt. The magnitude of this tilt (Table 1) is similar to that of subject F.H. (Figures 5, 6, 7) but an important difference exists. Compare the threshold value at the point of maximum sensitivity in the amblyopic eye with that in the non-amblyopic eye. The reader will note that this individual exhibits a reduced sensitivity in the amblyopic eye. It is difficult to know at what level this reduction in sensitivity occurs. If the maxima are equal, one can say the retinas have equal photochemical concentrations, but if they are not equal one can make no further statement as to the locations of the deficiency (as determined by this test). It is interesting to compare the visual acuity of R.W. and F.H. Obviously this second factor is playing a major role in reducing this individual's acuity. While no individual has been found to date in this series showing this reduced sensitivity factor alone, it is possible to hypothesize that such individuals exist.

PATIENTS SHOWING NORMAL ORIENTATION AND SENSITIVITY

Subject C.M. (Figures 17, 18, 19) showed what might be called essentially normal patterns in the two eyes as defined in Table 2. There is some simple tilt in his amblyopic eye, but this is an amount which is found, not unusually, in testing normal individuals. Sensitivity is equivalent at the maxima, but there is some difference at $r = o$. It is difficult on this basis to assign the cause of this individual's amblyopia to differences in orientation or sensitivity. Hence, in this case, one must look elsewhere for the deficiency (see discussion of patient's characteristics

above). Obviously, many such cases must exist, since amblyopia may have its origin at any of several levels in the visual pathways.

DISCUSSION

Obviously, this report represents only the beginning of a long series of investigations. However, at this point several factors stand out. First, it may be said that it is possible to define a class of amblyopia associated with the retinal receptors. Second, methods, although cumbersome at this time, are available for detecting those individuals manifesting receptor amblyopia. It would seem that the method herein employed is capable of detecting a minimum of two, and possibly three or more types of amblyopia. Further, as is obvious, not all amblyopia is associated with the retina.

It is felt that these findings support the theoretical statements discussed at the beginning of this paper. However, one reservation should be noted. That is, where certain parts of the theoretical discussion were concerned with relationship between immediately neighboring receptors, measurements taken with a test field even as small as 0.58° represent the integrated response of a statistically large number of receptors. In interpreting these data, it is useful, but not necessarily correct[6] to assume some degree of uniformity of conditions across the image of the test field on the retina. It is upon this assumption of uniformity that the term general malorientation is derived. The same result could conceivably be obtained by reasoning that n groups of receptors are oriented differently within the test field and their integrated pattern results in a flattening of the directional sensitivity curves. What really is not known is the size of n.

Turning attention to another phase of the problem, one can ask two questions, how do such conditions come into being, and to what degree can the orientation of the receptors or receptor components be modified by treatment of some sort? Before any consideration at all can be given to these questions, one must first determine to what degree this is a dynamic system. It has been known for some time that the direction of maximum sensitivity of the retina shifts slowly with time.[11] This author has seen it occur in his own studies.[12] One may then ask, what are the possible causes of these shifts? Three things come to mind if one excludes natural and induced (e.g., ultrasonics) trauma and pathology. The first is accommodation. In the nineteenth century it was well known that the retina moved during accommodation.[13] That large areas of the retina are under stress during accommodation can be readily demonstrated by viewing accommodative phosphenes.[14] In a study related to Stiles-Crawford type data, Ronchi[15] showed that the patterns change as the effects of cycloplegia wear off.

The second factor inducing physiological change in receptor orientation is the possible effect of gravitational force. Since the outer segments of the receptors are not firmly attached to the pigment epithelium, it is conceivable that centrifugal and centripetal forces will affect their orientation. Data of White and Jarve,[16] and White[17] on effects of "G" force on visual acuity and absolute thresholds are most suggestive of orientation changes (however, alternative theories have been presented describing these phenomena).

Lastly, LeGrand[10] has shown that the direction of maximum sensitivity changes slightly with level of luminance. This is an intriguing finding. It is difficult to conceive that contraction of the pupil puts traction on the retina in the same manner as the ciliary body does during accommodation. If this assumption is true, and the same receptors are operative at different luminance levels (LeGrand does not make this assumption), one could then assume the phenomenon to be intra-receptor in nature. Although this discussion deals primarily with retinal cone vision, Denton[18, 19] has shown that the photomolecules in rods are oriented, and that changes occur in their orientation during bleaching. There is no reason to assume that the same is not true of the photosensitive molecules in cones.

Thus, some small amount of evidence exists suggesting that the retinal receptors are in a state of flux, and exposed to various influences which tend to disturb both their external and internal orientation. Zimmerman[20] has recently been studying the characteristics of a ground substance which exists between the outer segments of the receptors, and between the receptors and the pigment epithelium. Such a substance would tend to maintain the proper orientation of the receptors. One can conceive that conditions might exist where the nature of this substance would be altered. If such were to occur, these retinas might be more susceptible to changes in orientation.

In a similar sense, several authors have recently demonstrated the presence of (largely ultramicroscopic) fibrils on the inner surface of the pigment epithelium. One would imagine that they too would tend to maintain orientation. Degeneration or hyperplasia of these fibrils would probably alter receptor orientation factors.

Work in the coming years will include several facets of the total problem, as well as an expansion of the current series on the etiology of amblyopia.

SUMMARY

A theory has been presented which predicts a change in visual acuity and brightness discrimination if the alignment of that which is

oriented in the retina is disturbed. Four of five amblyopic patients tested showed a non-normal directional sensitivity, and hence a non-normal receptor orientation function.

It would appear that the technique employed is capable of identifying three separate types of amblyopia, i.e., simple tilt, general malorientation, and reduced sensitivity. As expected, it was found that types of amblyopia exist not covered in these categories.

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SOME CLINICAL OBSERVATIONS FOR OPTOMETRISTS WORKING WITH LOW VISION PATIENTS*

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The main purpose of this paper is to offer some clinical observations to optometrists on a number of points related to their approach to patients. Comments are made on some personality characteristics of low vision patients, the criterion of successful prescription of optical aids, three main approaches toward a patient, and types of questions and answers which may help the optometrist gain psychological insights with his patients.

SOME PERSONALITY CHARACTERISTICS OF LOW VISION PATIENTS

The results of our psychological study* with 60 selected low vision patients from two different clinics showed that personality characteristics are related to the acceptance or rejection of optical aids. Generally, it was found that the patient who was friendly, optimistic, active, neither submissive nor domineering, and self-accepting tended to accept optical aids while patients who were hostile, pessimistic (or overly optimisitic) extremely passive, domineering, and self-repecting tended to reject the use of optical aids.

Not all people fall neatly into these two personality patterns so that the authors found it necessary to refer to a "mixed type" where someone might be friendly, optimistic, submissive, passive, and self-rejecting, etc. The mixed type might become an acceptor or a rejector depending upon many factors including the patient-optometrist relationship and the dominant patterns of personality expression of the individual. In other words, the quality of the interaction between the optometrist and the patient may determine, in large part, whether the mixed-type will accept an optical aid.

It should not be assumed that the rejector type necessarily will reject an optical aid and that such patients, when identified, should be

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*For a complete technical report of this study, see a forthcoming publication by the American Foundation for the Blind entitled, "The Relationship Between Five Selected Personality Characteristics on the Acceptance or Rejection of Optical Aids in a Low Vision Population."

ignored. On the contrary, the authors of this paper feel that all patients deserve the attention they need to help themselves to a better life. In addition, the authors believe that improved ways of working with "mixed" and rejector types of patients can encourage potential rejectors of optical aids to become acceptors. Finally, it is assumed that "acceptors" do not automatically accept optical aids no matter what the optometrist may do but rather, that the art of working with people in a professional manner must be respected. What the optometrist does psychologically* and how he does it both affect the degree of success with his patient.

THE CRITERION OF SUCCESSFUL PRESCRIPTION

The results of our study revealed that there is a need to clarify the criterion of success. For instance, in one-third of the cases, a follow-up study revealed that changes were made in designation of a case. In the opinion of the authors, there was an underestimate of 32% of the degree of successful prescription by the personnel involved. There are at least three significant points to consider in the criterion problem. First, there was the problem of *defining* success. For some cases, so long as a patient used any optical aid, it was considered a successful case. For others, if the patient didn't use the aid prescribed by the optometrist, even if the patient used a less efficient aid, the case was classified a failure. Since it is possible for the optometrist to prescibe an aid on technical grounds to which the patient *should be able to adapt*, it is possible that the optometrist is overestimating the adaptability of the patient. If less powerful aids were prescribed, and in addition, at a slower rate, it is possible that some patients who are considered rejectors might turn out to be acceptors. In our study, we found these points to be true. We would recommend as a definition of "success," therefore, the following: the use of an aid successfully to carry on life's many daily and varied activities in accordance with that person's style of living.

A second phenomenon which we observed was that as the experience of the patients and optometrist increased, patients accepted more intelligent help and optometrists were able to prescribe better aids in a more efficient manner. In addition, as every optometrist knows, people with similar visual accuity do not necessarily utilize their eyesight to

*The authors are assuming professional competence in the diagnosis, prescription, and dispensing phases of his work. To plead that the optometrist is not a psychologist is only to ignore the fact that the patient-optometrist relationship is a highly psychological one and that the latter does possess insights which he may not verbalize or consciously utilize.

the same or maximum vision. So, too, with aids, persons with similar limitation and potentials do adapt differently to their aids.

The third point has to do with the changing eye condition of the patient. As poor vision increases, optical aids lose their value. Such patients should not be classified as failures, but rather as those who are unable to profit from aids. In summary, then, we feel that optometrists need to set their sights for success in such a way as to include not only what the patient technically can use but also what the patient can adapt to in the light of his personality and his functional needs.

THREE MAIN APPROACHES TOWARD A PATIENT

The goal of the optometrist is to provide his patient with an aid that is of optimal value for him. In addition, practical considerations must be taken into account too. The authors refer to such considerations as the trained personnel and the time available for optical aids services, the number of patients to be serviced, and the fees that can be charged. While patients are entitled to the best services a professional optometrist can provide, the latter are entitled to be compensated adequately for the time and the care given to each patient. In the light of such realistic factors, each optometrist probably works out for himself his own way of working with his patients as well as his fee scale. In so far as each professional person is different, one should expect each optometrist to relate to his patients in his unique way.

The discussion which follows is merely an attempt to point up the values which can accrue from a flexible approach to patients. There is no intention on the part of the authors to blueprint for all optometrists how to handle their patients nor what questions to ask them.

The experienced optometrist has learned in his practice how to function most effectively with a given patient. Not only does he know what routines he must follow in the process of examination, diagnosis, and prescription but he has mastered the necessary social amenities in the interpersonal exchange. In a sense, then, the patient fits into the patterns of behavior that the optometrist has found most helpful to his patients and to himself. The advantages of this imposed approach on the patient are obvious in terms of time-saving, energy-conserving, and efficient performance.

When the optometrist encounters a patient who does not fit into his professional patterns, there are a few choices available. The optometrist, knowing that it is not his own fault, but that something must be wrong with the patient (since he does not respond in the normal and expected way), might continue his best approach and let the chips fall where they may. Another optometrist may decide to modify his

habitual approach and try to understand the patient. The optometrist might try to encourage the patient to express his own attitudes, skills, and understandings concerning his eye condition and aids, so that like an artist, the optometrist can fashion his techniques and prescriptions in accordance with the patient. The reader at this point should be saying to himself, "Of course, a good optometrist should do both, not one or the other." The authors agree with the reader and suggest the third approach which combines efficiency and flexibility as well as further insights into patient-optometrist relationships.

QUESTIONS AND ANSWERS*

The experienced and competent optometrist usually asks his patient a number of questions during the course of initial and follow-up examinations. These questions are appropriate to the type of patient, his eye disease, and his problems of being fitted with aids. It is not the purpose of this section to provide a list of questions which should be asked. Rather, we thought we would provide practical illustrations of types of questions and types of responses which would help the optometrist to size up acceptor or rejector types of patients. Although there are some questions which the optometrist may need to ask which require a yes or no response, (Are you married? Do you attend school? etc.), the authors suggest a general open-end type of question in order to gain psychological insights into the patient's personality. By open-end type of question we refer to ones like: "How are you?" or "How do you feel?" in contrast to a question like "Are you feeling well today?" The latter encourages a yes or no response while the former are more likely to elicit feelings and information about the patient. For instance, when an optometrist asked a 50 year old man, "How are you?" He responded, "I've been no good since I had my stomach removed." The feeling as well as the content of the response tends to give the clinical impression of a man who is self-rejecting.

If the optometrist were interested in tapping attitudes towards other people, the following kinds of questions may be helpful:

How is the world treating you?
What do you think of the news? (News about people or nations.)
What would your friends think (or say) about this?
Did your friends (or family) comment about your aid?
Did anybody notice your new spectacles?
How are things with you?

*The authors are very much indebted to Dr. George O. Hellinger, Industrial Home for the Blind, Brooklyn, N. Y., for invaluable help on this section.

The significant way to listen to what the patient responds is to try to catch the feeling as well as the content or meaning. One 30 year old married woman responded to the question, "How are you today?" with a hostile tone and the following: "I tried it (the optical aid) and it is no good. Who are you kidding, Doctor? You know I'm going blind." One can gather from this response (which was typical of other remarks made by this patient) that there is an hostility and pessimism about the patient's viewpoint.

Active or passive characteristics of the patient may be sensed through such questions as:

What do you do to pass the time away?
What do you like to do?
How do you have fun?
What interests you?
What do you like to read?
Who helps you get things done?
What do you need help with?
What do you do on your own?

Patients who respond by saying that they watch television all day, go nowhere, or occasionally are taken for an auto ride obviously reflect passive types. Those patients who speak of going ice skating, bowling, and horseback riding, or who are building their own home or constructing a hi-fi set, or who travel alone, tend to reflect an active type, or doers.

It is characteristic of open-end questions that patient responses may be so varied as to provide information about himself on more than one personality characteristic. For instance, the question, "Do you have any preference for frame or color?" may be answered, "Yes, I like the x type of frame and a light gray color because I always look attractive with that shade." Such a patient reflects self-acceptance as well as friendliness. In contrast, a patient might respond, "Any old frame and color is good enough for a blind dog like me. Besides, Doctor, which is the cheapest? You know they are always trying to sell you expensive frames so that they can make more money from you. Why do they have to take advantage of us blind people all the time?" Not only does one sense self-rejection and self-belittling but also hostility toward others as well. There is even a feeling tone of pessimism coupled with a submission to those who are always "exploiting them."

Some optometrists might raise their eyebrows at this point and question whether they are being asked to become psychoanalysts. They might wonder about trying to interpret their patient's behavior. The

authors assume that competent and sensitive optometrists are always consciously or unconsciously reacting to their patient's behavior. Obviously, the above patient who was antagonistic and suspicious of the optometrist is displacing these feelings from another situation onto the optometrist. Without thinking about this, competent optometrists therefore, may know that the patient is upset (but not at the optometrist) and would treat the patient accordingly. It is because the authors assume that when professional workers react consciously and knowingly they can function more effectively than if they were unaware of the patient's personality patterns. In the above illustration, unless the optometrist was conscious of the patient's hostility towards others, he (the optometrist) might respond to the patient with belligerency rather than patient understanding.

When the optometrist becomes aware of how he experiences his patient (as either an acceptor, mixed, or rejector type), he is able to strive consciously to provide the patient with the appropriate attention he needs to adapt to an aid. The acceptor type is likely to be cooperative since he is friendly, generally optimistic, active, and wishes to help himself because he respects himself. The acceptor type will probably need the least number of clinic visits and will be experienced by the optometrist as a nice person.

The mixed type of person will be a bit more baffling to the optometrist. This type of patient will not be clear about what he wants, what he can do, and whether he will or will not go along with professional recommendations. He may be friendly and active but very pessimistic, submissive, and self-deprecatory. Such persons need to be handled cautiously and may require additional visits. It is probable too that the help of a psychologist or a psychiatric social worker may be required to reduce the ambivalence toward treatment and prescriptions.

The rejector type will be experienced by the optometrist as a most difficult person. Since he tends to be negativistic, hostile, and pessimistic, the optometrist may be tempted to throw up his hands and exclaim, "Take it or leave it" and find that the patient leaves it! Since the rejector type tends to be self-rejecting, he probably does not or is unwilling to accept his eye condition. He may prefer an easy way out, that is, to wait for a miracle cure. In some cases, the rejector may need his disability in order to act out various personal needs to punish others or himself. These negative personality characteristics should be looked upon as covers for deeper feelings of inadequacy and anxiety. It is for this reason that counseling or psychotherapy may be essential if the rejector is ever to accept an optical aid.

In summary, the authors have shown that certain personality characteristics seem related to the process of accepting or rejecting optical aids among low vision patients. A discussion of the nature of the criterion of success and types of questions and answers which should be considered during the clinical interview were presented. General suggestions were offered on how to handle the three types of patients who come for help at clinics.

THE TELECON LENS FOR THE PARTIALLY SIGHTED*

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Efforts to develop a telescopic system consisting of a contact lens as an eyepiece and a spectacle lens as an objective have thus far met with little success. As a result of the aberrations inherent in such lens systems and the change in axial distance between the contact lens ocular and spectacle lens objective as the eye rotates from the primary line of regard such systems have been rather unsatisfactory. The new design here suggested would eliminate some of these difficulties although it would not completely solve this problem.

The Telecon lens is a contact lens constructed with the proper base curve (R_2) required by a given eye for comfort and a front curve (R_1) selected to give the best visual acuity without magnification. The central 2.5 mm. of R_1 is reground with R_3 to incorporate —50.00 diopters (see Figure 1).

It is important that this —50.00 D. portion of the lens occupies a diameter (D_3) which is significantly smaller than the patient's pupillary diameter. This contact lens unit consisting of a central 2.5 mm. negative area and the remaining regular contact lens in the peripheral area, forms the ocular of the telescope system.

The objective of the system (Figure 2) consists of a spectacle lens carrier of plano power (L_1) ground on a 12.00 D. base curve to which is cemented a +25.00 D. central segment (L_2) of 10 mm. diameter (D_4). The spectacle frame is so adjusted that L_2, the objective of the telescope, is separated from the contact lens eyepiece by a distance of

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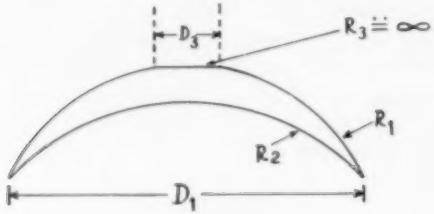

Fig. 1

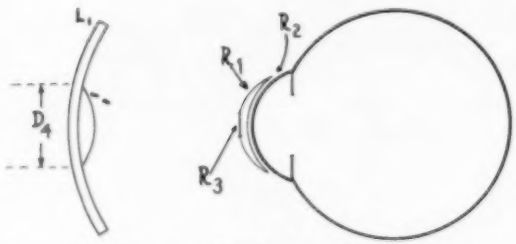

Fig. 2

approximately 20 mm. Thus a magnification of 2X is obtained.

The main advantage of such a system is that the patient really has two optical systems to see through. The central system of about 18° has a magnification of 2X: the peripheral system has unit magnification. Since both fields are observed at the same time, the patient overcomes the problem of telescopic parallax. As long as his visual axis passes through lens L_2, he has a central magnified field superimposed on a broad normal field of vision.

The disadvantages of this system are obvious. When the patient's visual axis or line of regard does not pass through L_2 he will retain normal vision in the periphery but will have a blurred central field due to the presence of the —50.00 diopter lens.

To minimize the effect of this disadvantage clinically this Telecon lens has been used in only one eye of patients who have some useful vision in both eyes. Thus they can, for special tasks, direct their attention to the central magnified image, and for ordinary travel vision use the central field of the other eye together with the peripheral field of both eyes.

The cosmetic advantages of a system such as that presented here are sufficient to suggest its use in selected cases.

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THE COLOR RATOR: A NEW INSTRUMENT FOR THE ASSESSMENT OF COLOR APTITUDE IN INDUSTRY*

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INTRODUCTION

The purpose of this paper is to describe the use of a new instrument designed to assess color aptitude. The need for such an instrument was first suggested to the writer by a local industrialist who is engaged in freezing, canning and processing fruits and vegetables. Large quantities of his products had been downgraded by the Federal Food Inspectors. The difficulty was traced to employees stationed at the sorting belts whose job it was to remove fruits of sub-standard color. He felt that if a method could be found to select employees with exceptional color aptitude it would prevent the assignment of people with poor color aptitude to those jobs requiring fine color discrimination and greater efficiency would result. It should be emphasized here that this is not an attempt to bar people from jobs. In the seasonal fruit industry there is room for persons of all degrees of ability in the recognition of color.

This problem of color aptitude is not limited to the fruit industry and should be considered during the formative school years. Vocational counselling in our schools should take into account the need for adequate color vision in certain industries. Information on the nature of color blindness and the educational and vocational handicaps it represents should be provided to students and parents. This should be done prior to any extensive planning for advanced technical training and before any final vocational decisions are made. Many fields require exceptional color vision: for example interior decorating, printing, chemistry or electronics where components are often color coded. In this modern age there is a definite trend toward making even the most commonplace object more attractive to the consumer through the use of color. As Gordon Walls has so well put it, "the day has come when the only way a man can tell his razor from his wife's is by the color!"

The problem of the employee with poor color vision is not new. For many years the United States Department of Agriculture has sup-

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plied to its inspectors various plastic color comparators to help establish standards for quality control based on color. These polystrene plastic discs are available for a wide variety of fresh and processed foods and are used to compare to the product to be graded. Their use, of course, presupposes adequate color discrimination on the part of the user.

The fabrics industry has a similar problem. Their need for accurate quality control in the field of color is evidenced by the multitude of gadgets they have available for color matching. The best of these[1] is the Glenn Colorule which is a very good color matching device indeed provided that the person using it has normal color discrimination.

Since the use of standardizing color control instruments requires the ability to make discriminations between colors that are not greatly different in hue or saturation, there is a basic problem of selecting people with good color aptitude, to use the many quality control instruments available. It is important, then, that a testing instrument is available to assess qualitatively this discrimination ability.

COLOR VISION AND TESTING INSTRUMENTS

There is much discussion and research at present in the field of color vision. There is a continuing list of new tests for types of gradations of color discrimination in the literature. Pickford[3] says that we need better testing devices: not merely rough screening tests to sort out the ten per cent or so of abnormals, but new tests that are truly diagnostic of color discrimination capabilities in various regions of the spectrum. More than one writer has emphasized that several degrees of color blindness exist. Any examiner working with color deficient people is constantly amazed to find that these people are over sensitive in regard to this defect. Such things as lowered visual acuity, heterophoria, or poor stereopsis are usually accepted philosophically by the individual. However, most color deficient individuals greet a color perception test with much apprehension and quickly rationalize their failures. Upon further discussion with many of these individuals, it is found that their difficulty with color was something that had to be hidden and that they were ashamed of having such a defect. It might be possible to replace the term color blindness with some less ego-damaging phrase. It has been suggested that the term color weakness be substituted for color blindness but the latter term persisted. It has even been suggested that we give up all classification by types, arrange color defectives in distribution tables and give a color graph or profile for each subject.

A particularly puzzling group of color abnormals, the anomolous trichromats may offer one piece of evidence that the testing of color perception cannot be arbitrarily divided between normal and defective. It

is conceivable that proficiency of color perception might constitute a continuous range from normal to complete red green deficiency. The measurement of color vision could then be made analagous to the measurement of visual acuity. In the field of visual acutity we have long since progressed from the gross measurement of light perception only and 20/20 Snellen type.

It is understood that there are three variables that comprise a color sensation:[2] (1) Hue, the dominant wavelength or predominate wavelengths of the stimulus. (2) Saturation, the relative amount of white light mixed with a stimulus of given hue. The stimulus containing less white being considered more saturated. (3) Brightness, the intensity of the stimulus or its place on a scale ranging from black to white.

To test these variables several types of instruments have been developed. First, there are the pseudo-isochromatic plates. Examples of these are the Ishihara, Dvorine, Stillings and the new American Optical Company Hardy, Rand Rittler series. These tests, although good for quickly indicating the more obvious cases of color blindness, do not ordinarily disclose a person's ability to discriminate hue and saturation. Several authorities have indicated that these give variable results from one edition to another and must be administered under fixed conditions of illumination and exposure.[4, 5, 6, 7, 8, 9, 10]

There is also the excellent color aptitude test prepared by the Color Vision Committee of the Inter-Society Color Council.[11] Although this test is very exacting it is also very time consuming and fatiguing. It is therefore quite unsuitable for general industrial use. The Farnsworth-Munsell 100 Hue Test is also in this category and thus suffers from the same disadvantages.[12]

In 1881 Lord Raleigh showed that anomalies of red green vision could be studied by a color equation in which a variable mixture of lithium-red and thallium-green was matched against a sodium-yellow of variable intensity.[13] The instrument designed to carry out this color equation is called an anomaloscope. Several forms of this instrument have been produced using either spectral lights or filters. The anomaloscope has great advantages over the wool yarn tests and pseudo-isochromatic plates for the detection of color blindness.[3] Some anomaloscopes can be set up so that the subject makes all adjustments and the colors to be matched can be under control in hue, saturation and brightness independent of each other.

Considerable emphasis has been placed on the anomaloscope as a test because it stands between the color plates and a painstaking laboratory analysis of the exact characteristics of a subject's color vision. The

anomaloscope would seem to be the instrument of choice for industrial use if it could be simplified to meet the standards required by industry. Industry would require: (1) that a series of norms be determined and the limits of color discrimination be established. (2) That a lay person could operate the instrument. (3) That a simplified form and procedure be available. (4) That a pass or fail decision could be determined *immediately* after testing.

DESRIPTION OF THE INSTRUMENT

The instrument called a Color-Rator is best described as a device for the qualitative assessment of hue and saturation discrimination. It consists of a lamp compartment, two sets of filters and racks, two light diffusion chambers, a viewing aperture, and a pair of calibrated dials.

The lamp compartment is located at the rear of the color-rator and contains a single filament, tungsten, sixty watt mazda globe. This light source is located in the center of the compartment. The front partition of this compartment contains two apertures measuring two inches square. These two apertures allow equal amounts of light to enter the two light diffusing chambers. In front of each aperture there is a moveable slide holding red and green filters edge to edge, so that the aperture may be covered with any desired proportion of red and green. The filters used are two layers of Wratten #29 for the red and a Wratten #15 superimposed on a Wratten #61 for the green. These filters were chosen to transmit approximately equal intensities of light and thus eliminated one of the three variables mentioned above.

The two light diffusion chambers are equal in area and divided by a septum. The anterior portion of this septum contains a very thin, completely opaque black paper which serves as an almost invisible dividing line between the two semi-circular halves of the front frosted glass viewing aperture. The diffusing chambers contain two baffles so that no direct light from the filters can reach the front viewing aperture.

The front viewing aperture consists of a circular frosted glass area eleven sixteenths of an inch in diameter divided by vertical diameter. This size has been computed so that when viewed from a distance of twenty inches it will subtend an angle of two degrees on the retina, and thus essentially cover the macular area. To insure the proper viewing distance of twenty inches an extension arm is provided. This extension arm attaches to the front of the instrument and positions an eye piece with a one-quarter inch diameter hole in direct line with the viewing aperture. All observations are made monocularly from this position.

At the rear, or examiners end, of the instrument there are two dials mounted on two equally calibrated scales. One dial, attached by a bar

and pinion device to the right hand filter set, is used by the examiner to set the color mixture to be matched. The other dial, attached by a bar and pinion device to the left filter set, is moved by the subject to achieve his color match. The examiner can also move this dial to reposition it between settings.

TESTING PROCEDURE

The examiner sets the right hand dial at the indicated setting and instructs the subject as follows, "match the color which is on the right hand side of the window. Do this by turning the knob slowly in either direction. When you think that you have made a match, please say 'match.'" The examiner then records the subject's setting in the appropriate place on the record form.

The record form provides for an initial series of six settings to establish the subject's comprehension of the testing procedure. A second series of 24 settings consists of eight settings at each of three different wavelengths. The highest and lowest settings at each of these three wavelengths is then noted. The difference between the highest and lowest reading is recorded in the appropriate square. These three figures are compared to the established norm for that job, and thus is determined the pass or fail classification.

It should be noted here that the color-rator does not require a knowledge of hue names or other color terminology. A color discrimination or judgment of equality only is required. The results will be the same regardless of the observers background with respect to color names. Furthermore, the instrument in its present form is not greatly different from the design of an optics free anomaloscope. Thus, it is anticipated that certain modification of the existing instrument will permit it to be used as an anomaloscope.

STANDARDIZATION AND DISCUSSION

It was necessary initially to conduct a standardization procedure. A group of 21 subjects was tested and the results were tabulated. Each subject was required to make three settings at each of four wavelengths on three consecutive runs. The four wavelengths consisted of the following percentages of red and green:

Wavelength*	Green	Red
35	80%	20%
45	60%	40%
55	40%	60%
65	20%	80%

*Arbitrary scale units.

From the data for the 21 subjects it seemed apparent that the range of settings for a given subject at a given wavelength was a satisfactory

criterion for passing or failing the test. The use of the average range and/or the mean setting was rejected. The range criterion requires only the noting of the highest and the lowest settings and simple subtraction. The distribution of the ranges of settings for the 21 subjects showed that at any wavelength a range of settings greater than ten scale units was sufficiently different from the general distribution of ranges to suggest this as a limit of acceptance. Thus, a subject passed the test if his range of settings at all wavelengths was ten scale units or less. The subject failed the test if the limits of his range was more than ten scale units of any wavelength.

SUMMARY

One of the requisites for success in many occupations is good color aptitude. An instrument has been described for the determination of color aptitude or color discrimination within the red and green portions of the spectrum. The matching principle, or null method for zero difference, is used. An additional advantage of this instrument is that the procedure as outlined is sufficiently simple for its administration by a lay person at the employment level of industry. Criteria for its use are proposed from a preliminary study of 21 subjects. Range of settings at various wavelengths were adopted as principle criteria for pass or fail decisions.

ACKNOWLEDGMENTS

The writer wishes to thank Dr. Gordon L. Walls for originally suggesting the underlying idea for the instrument, and Dr. Merton C. Flom for his assistance in evaluating the data.

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ANNOUNCEMENT

NEW BOOKLET—MILE-A-MINUTE EYES

One of America's most prolific writers on the subject of safe driving is Paul W. Kearney, author of *I Drive the Turnpikes and Survive* and many other similar articles. In this new booklet Kearney points that at times visual problems not revealed by tests required for driving licenses are the cause of automobile accidents but that once such weaknesses are detected they are easily corrected.

Mr. Kearney marshals facts and figures so effectively that the reader is convinced that, regardless of state law, he should have his eyes carefully checked before he takes to the road. Few drivers realize that much more demand is made on the eyes at 60 miles an hour than when one is standing still or moving at a slower rate. Mr. Kearney warns the reader that he may have 20/20 vision while reading, but have eyesight deficiencies at mile-a-minute speeds. He points out the importance of checking all seven key points to mile-a-minute vision, such as visual acuity, visual fields, depth perception and binocular vision. The booklet gives simple tests the reader can take to determine whether or not he has a weakness in any of the key areas which requires attention from an optometrist.

This new booklet is available from Birk & Company, Inc., 22 East 60th Street, New York 22, New York. The cost of a single copy is 25c with large quantity discounts. A stack of these booklets belongs in every optometrists reception room.

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AVENUES OF REFERRAL SHOULD BE KEPT OPEN

The cold war between ophthalmology and optometry is now entering its fifth year. The breach, ostensibly created by the misinterpretation of an ambiguous, hastily prepared, and poorly thought out optometric resolution in 1954, widened with a series of equally ill-conceived, retaliatory ophthalmological resolutions in 1955. Hope for reconciling differences were dashed for the time by the formation of the National Medical Foundation for Eye Care in 1956 which launched a vigorous attack against optometry. Now, however, there are occasional signs that this cold war may have reached its peak and that more rational thinking in the two professions may once again prevail.

In an article in MEDICAL ECONOMICS Tucker* points out that some physicians are beginning to feel that the N.M.F.E.C. may be fighting too vigorously. He states:

> A few observers have warned that a really bitter quarrel with non-M.D. "special-

*Tucker, R. W. "One way to cope with nonmedical 'specialists.'" *Medical Economics;* October 27, 1958, pp. 131-144.

ists" is bound to result in an upsurge of ill will. They fear that resentment against the medical profession can spread from the optometrist to the podiatrist to the psychologist—and eventually to the public.

Tucker also quotes Dr. William Benedict, secretary-treasurer of the American Academy of Ophthalmology and Otolaryngology, as having fears that no good can come of the situation created by the political bodies of the respective professions issuing resolutions like those of 1954 and 1955. Tucker also quotes another "well-known eye man" who states:

> The N. M. F. E. C.'s efforts may well boomerang. We depend upon optometrists more than most of us like to admit. Can we really afford to alienate them? There's no law that says they have to send us patients. And it isn't just our pocketbooks that'll suffer if they stop referring people to us. It's the patients too.

Tucker concludes his article with a quotation from the statement of policy made by Dr. Lester A. Sugarman while he was president of the A.O.A. and the reaction to this statement of one physician, who is quoted as stating:

> If that's really their attitude now, I'd say the N. M. F. E. C. has proved its mettle. After all, we're not out to "get" the optometrists. We'll be glad to work *with* them for the good of all our patients.

It is heartening to note that some medical leaders are aware that the breakdown of amicable relations between optometry and ophthalmology can only work to the detriment of both professions and of the public. Happily, too, optometry's counter-attack to the virulent Foundation propaganda has been held back by cooler heads.

Interestingly enough, throughout this cold war, practitioners in both fields have realized the effect of a loss of communication on their patients and most have continued to work together for the welfare of their patients. The cold war has existed mainly on the political level and has had only occasional influence at the grass roots level at which the doctors in each profession work with their patients.

Despite the fact that practitioners are little affected by this cold war between the politicians in each group, it would be well were it to end and were avenues of communication reestablished. In working toward this end, the leaders in both groups might keep certain fundamental truths in mind.

(1) *Both professions exist and will continue to exist in the foreseeable future.* This is true because both professions have the support and confidence of the public and because they serve a definite need. If either fails to measure up to the public's demands and standards, it will fall without any help from the other. From a practical point of view, vision care in the United States today requires both groups, and neither group alone could give proper service to the public. Both professions are here to stay and there is no choice in the matter. The only

choice is whether they work together or whether each attempts to degrade or do away with the other and, in so doing, drags itself down.

(2) *Each profession places the patient's welfare above all other considerations.* This fact is demonstrated by the day to day actions of almost all members of each group. To be sure, there are renegades in each group who seem more interested in selfish ends than in service to the patient, but for the most part, this is not so. Standards of ethical behavior are instilled in the student in each group in his college days, frequently at the same university. It is far-fetched to ask anyone to believe that one department in a university would train the student to adopt an attitude of placing the patient's welfare above his own, while another department would instill the converse attitude in its students. Each group, then, by its training, by its avowed statements of policy, and by the actions of most of its members, is truly dedicated to the public welfare. Each must have as much confidence in the other's desire to do right as it has in its own. Neither group has a monopoly on ethical standards, morality, or honesty.

(3) *The patient will be best served if the relationships between the two groups are close and amicable.* Conversely, the patient's welfare must suffer if the optometrist and ophthalmologist isolate themselves. The patient benefits in a number of ways by close cooperation of the two groups. Neither group has all of the technical knowledge and information and members of each group benefit from a free exchange of information. If it is realized that the optometrists' knowledge of recognition of pathology is dependent upon ophthalmology, it must also be realized that the ophthalmologist is indebted to optometrists for many of the developments in the fields of subnormal vision and contact lenses. As each learns from the other, the patient must benefit.

In a cold war each group points to the actions of the worst members of the opposing group rather than to the majority. Thus, ophthalmology can single out the patient with glaucoma which an optometrist failed to recognize, but optometry can counter by citing a patient with glaucoma which an ophthalmologist failed to recognize. Optometry can point to an obvious refractive error which an ophthalmologist missed, but ophthalmology can find a similar patient missed by an optometrist. As each group takes its case to the public, the net result can only be a lessening of public confidence in both groups. Neither profession is composed of supermen: each is made up of fallible mortals. Neither group can point to the faults in the other without destroying public confidence in both professions. Both groups need public confidence in order to give the best service to the patient.

Finally, the patient is best served if the avenues of referral are kept open. Thus far, for the most part, these have not been affected by the political cold war. However, they are endangered as the cold war continues. If the day arrives when these relationships are disturbed, the patient will again suffer. Each group will find a way to survive and fight for its share of patients, but the patient will not receive the excellent care from either group which he could receive if cooperation were existent.

It is a little early to know whether the straws in the wind indicate a cessation of the political hostilities between the two professions. We hope that they do and that the political leaders in both groups will begin to think seriously about ways in which the present breach may be healed. In the meantime, the doctors in both professions should continue to hold good personal relationships with each other at the grass roots level and continue to bring what pressures they can on their leaders. One thing is sure. If the present conflict is resolved, a great deal of the credit will belong to the practitioners in both professions for realizing the importance to the public welfare of amicable cooperative interprofessional relations, and for not losing their perspective during the past four years. The public is indebted to these men who see that in day-to-day practice, interprofessional cooperation is a necessity, not a luxury.

MONROE J. HIRSCH

ANNOUNCEMENT

VISION OF THE MOTORIST

The Optometric Center of New York is holding a Symposium on Vision of the Motorist as a Key Factor in Highway Safety from 9:30 A. M. to 1:30 P. M. on Sunday, April 5, 1959, at the Barbizon Plaza Hotel, Central Park South, New York City. Dr. Alder N. Haffner, Executive director, will preside.

Nine speakers, each an authority in his own right, will deal with this subject and the program should attract a large number of optometrists and others interested in traffic safety. The registration fee is $5.00.

SPECIAL REPORTS

A.O.A. PRESIDENT'S ANNUAL ADDRESS BEFORE THE ACADEMY — "STATE OF THE PROFESSION"*

Hoyt S. Purvis†
Jonesboro, Arkansas

Distinguished guests, Fellows of the American Academy of Optometry, and Ladies, it is a distinct pleasure to be with you tonight on the occasion of your annual banquet where I have enjoyed both excellent food and good fellowship. Now it is my function to attempt in some manner to perform the difficult task of scientifically equating gastronomic pleasure with intellectual output.

Let me first of all extend to you greetings on behalf of the Board of Trustees of the American Optometric Association and commend you highly for your most successful session here in Boston. I have read the listings of postgraduate courses offered by the Academy and recognize the tremendous contributions you are making to the continuing education of the members of our profession.

Academies occupy unique positions of responsibility in professional organizations. The American Academy of Optometry can take justifiable pride in its leadership which for many years has met its responsibility to the profession of optometry and to the public which the profession serves.

The topic I have chosen tonight is "The State of the Profession." This is a very broad topic and one upon which I could talk for several hours. However, your committee has informed me that approximately 20 minutes on the program has been allocated to me—so I will confine my remarks accordingly.

The basic theme behind A.O.A.'s program for this year is "That We May Better Serve." This theme, as you can well imagine, has many facets, but we have set six specific goals to be achieved during the year. These are:

1. Postgraduate education.
2. Organizational leadership.

*Read before the annual meeting of the American Academy of Optometry, Boston, Massachusetts, December 15, 1958. For publication in the March, 1959, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Fellow, American Academy of Optometry. President, American Optometric Association.

3. Student selection.
4. Membership promotion.
5. Operation Saturation.
6. Practice management.

I would like now to inform you on the progress we have made toward achieving these goals.

Just six weeks ago, Boston was the setting for the first in a series of eight regional organizational meetings sponsored by your A.O.A. for top level state association leaders. Following the two day meeting here, similar meetings were held in Pittsburgh, Chicago, Atlanta, Dallas, Denver, Portland and Los Angeles. These meetings were labeled "Target for Today." A traveling team composed of Dr. P. N. Devere of North Carolina, A.O.A. president elect; Dr. Roy M. Swain of California, director of the Department of Legal Affairs; Mr. J. Harold Bailey of St. Louis, A.O.A.'s administrative director and your president, spent more than three weeks during the month of November traveling some 10,000 miles to present a program on interprofessional relations based upon "Operation Saturation," a program on state legislation, and a program for better state organization. The presentations were fortified with prepared manuals on the topics. These materials were left with state leaders. More than half of the time in these meetings was spent in open discussion, where your A.O.A. leaders had the opportunity to hear first hand what was happening over the land.

If I could make a wish tonight it would be for every optometrist to have had the same experience of meeting with these 250 leaders in your profession and to see and hear these leaders in action.

I can say now that I am more proud to be a member of this profession than ever before in my life. You have heard dark rumors, I am sure, about this profession's future, the insurmountable problems facing it and the story of gloom and doom. I can tell you here tonight that if what I saw and heard is true (and I have no reason to doubt it) optometry is a healthy profession with a future just as bright as we want to make it. In a brief summary this is what we learned:

Optometrists are serving more patients than ever before.

Incomes are keeping pace with the increased cost of living and in most areas are moving ahead at an even faster pace.

Relationships with other professions are excellent. In the health care field the activities of optometry's opponents have not materially affected the relationship between optometrists and the medical men to whom they refer patients.

Politically our state leaders are alert and seem to possess the know-how to handle political situations.

State leaders and national leaders alike are realistically viewing optometry's problems as *opportunities* and are moving ahead toward their solution with active, dynamic programs.

We found a desire everywhere to find new techniques for doing a better organizational job. Sleeves are being rolled up for more vigorous action in legislation, organization, and interprofessional relations.

Yes, the feeling we found was one of genuine optimism for the future based upon a realistic appraisal of optometry's prestige, demands for its services, and its unsolved problems.

Every problem has a solution, not as someone has put it: "There is always an easy solution to every problem, neat, plausible, and wrong." The solution for our problems will require hard work and sacrifice on the part of everyone in the profession. Nevertheless, a solution is always there, and we *will* find the right answer for every real problem facing this profession!

Many of you here tonight participated in the regional meetings. But whether you did or not, I am certain that you will hear more about these "Target for Today" programs as they reach down to the local level. I can report to you now that state after state is following through on the program of action outlined at these meetings.

Let us look for a few moments at two very important areas of concern to optometry. First, the area of securing students for our colleges.

We have heard about the need for students for the past several years. Organizationally, I feel that we have been doing a fairly good job on disseminating information and materials in the field of vocational guidance. But, what is the situation today? According to our Council on Optometric Education we have lost ground in our enrolling classes this fall. In the United States 22 fewer students enrolled in the entering classes of our accredited schools and colleges this year than last. Thus, the downward trend in student enrollment has continued in spite of our highest hopes for an upturn this year.

Let me say to you, that we as optometrists have not *individually* faced up to the student problem facing our schools and colleges *and* our profession. In viewing the situation we *must* look into the future. Our population in this country is gaining at the rate of approximately three million persons per year with an estimated population of 250 million just 25 years from now. This represents an increase of 80 million people during the next quarter of a century. Optometry today is just about holding its own in numbers of practitioners with a present per capita distribution of about one optometrist to each 10,000 population. If

we are to maintain this present ratio we will need to increase this total of practicing optometrists by 8,000 during the next 25 years.

Statistics will show that in order to accomplish this we need to graduate approximately 710 optometrists each year beginning *now*. If optometry does not meet the demand for these new doctors, the public will increasingly look to other professions to provide these services. A goal of 710 graduating optometrists each year could be achieved if every state association would accept the responsibility of producing students for optometry equal to 10 per cent of its membership each year. If such a program were inaugurated with *next* year's classes, it would be several years before it would produce additional manpower for the profession. If such a program were adopted, 25 years from now we should have approximately 28,000 practicing optometrists to serve the population of 250 million.

The 10 per cent figure I have mentioned would represent an average of only one student every ten years for each member of the association, or to put it another way, *one out of ten* optometrists would have to secure *one* optometry student each year. Student procurement is not a "let George do it" proposition! This is not a responsibility for someone else, it is *yours* and *mine!* We must personally encourage promising young people to enter this profession. Did *you* enter the profession because of something you read or as a result of an aptitude test? I doubt it! I would guess that most, if not all, of you were guided into the profession by the helping hand of an enthusiastic optometrist who inspired you to follow in his footsteps. This is the main route of student selection for a profession. Let's get to work on this now and talk about the opportunities in this profession to every prospect we can find. Use A.O.A. materials. Give them to prospective students. Give them to schools. It's good public relations!

Now, let's look at another major area of concern to optometry—that of interprofessional relations.

All of us are rightfully concerned about interprofessional relations, particularly with our medical colleagues. Most of our problems existing today are at the organizational political level. I can say that we are constantly working to improve these relations through every channel open to us.

You can do your part by improving *your* relationship with medical practitioners in your community. This will involve meeting them personally and discussing with them the material contained in the new A.O.A. booklet "Your Eyes and Optometry."

Will Rogers, the great humorist, once said, "I never met a man I

didn't like." With this philosophy he was one of our great ambassadors of good will. This can be adapted to our own personal living and particularly so in our relations with medicine. Contacts must be on a personal basis where we meet face to face with medical practitioners.

So, I would urge you to follow the program outlined in "Operation Saturation" and give your medical friends firsthand, accurate information about your profession. In so doing you can correct any misinformation they may have received from forces opposing optometry.

During the recent Social and Health Care Trends Conference in St. Louis, we had the privilege of listening to Dr. Michael Davis who spoke on the subject, "A Resolution of Conflicting Interests." He had this to say about interprofessional relations: "It would seem logical that professional people should resolve the differences between them by an exchange of undiluted intelligence. However, they are still human beings controlled by human emotions and possessing egos. The basis of professional conflict usually reduces itself to the formula of E + E or Ego + Economics."

That to me represents a good analysis of the basic interprofessional problem confronting us today. But, it will be resolved by us, or by others, in the best interest of the group that has the biggest stake in the professional services, namely, the *public* that receives the services and pays the bills.

Now, let me give you in rapid fire order some of the things that are happening within our states and within our A.O.A. committee structure.

1. I can announce here tonight that for the first time in 25 years, the American Optometric Association represents 48 affiliated state associations and the District of Columbia. At its meeting last week in Chicago, the A.O.A. Board of Trustees voted to reaffiliate the State of South Dakota which now makes us 100%. We have also started wheels in motion to affiliate a state association in Alaska just as soon as it achieves statehood.

2. A.O.A. is moving ahead on the educational front with increased postgraduate educational activities at the Annual Congress and in two regional meetings to be conducted this year. The first of these will be held in Baltimore in April and will present a program in the field of practice management.

3. Our very active Committee on Social and Health Care Trends is working now on a proposal for a national health service entity to correlate the activities of state optometric groups providing visual care services on a prepaid basis. This represents a most important area to the future of our profession!

4. Our Committee on Visual Problems of Children and Youth has been actively working in many areas and the tangible evidence of its work will produce at least three new manuals in its field this year.

5. In the area of national affairs, I am pleased to announce to you that Dr. Lester H. Sugarman, immediate past president of the A.O.A., has just recently been appointed as consultant to the Veterans Administration in Washington, D. C.

6. In the area of public information, your A.O.A. Board of Trustees and the Department of Public Information are now working on a long range plan of revitalized public relations to carry all of optometry's story to the public. Important announcements in this regard will be forthcoming from the A.O.A. in the near future.

7. Our Committees on Motorists' Vision, Occupational Vision, and many others are continuing to open new doors for optometry in the way of contacts with important individuals in government and in private organizations. We must not fail to provide sufficient manpower to follow through on all of the contacts that have been made in order that we can do a better job for the public.

8. Our Department of Organization is conducting a vigorous membership campaign, through our state associations, to enroll the eligible non-members who should belong to A.O.A.

These are only a few of the highlights of the state of our profession today. To all of these need be added the work of our own American Academy of Optometry, the American Optometric Foundation, the Optometric Extension Program, and the Auxiliary to the American Optometric Association. A review of the activities of all of these organizations combined with our regional, state, and local components of all of these groups clearly indicates that optometry is on the move!

I am confident now that when our year is ended we will have achieved the six specific goals we established under the theme, "That We May Better Serve." I am confident that our future is secure! I view this future with optimism knowing that we have no crisis nearly as serious as the many faced by our predecessors who took them in their stride. Administering to the welfare of the public which we serve is a high calling! Let us once again re-dedicate ourselves as *individuals* to the work of our local, state and national optometric organization so that we may better serve mankind.

212 E. WASHINGTON AVENUE
JONESBORO, ARKANSAS

SCHOOL SCREENING IN R-1 JEFFERSON COUNTY, COLORADO—A BRIEF STATISTICAL REPORT*

Otto J. Bebber†
Denver, Colorado

Last year the writer outlined a school screening program being used in the reorganized school district known as R-1 in Jefferson County, Colorado.[1]

It might be well at this time to review the type of instrumentation in order to properly evaluate the statistical data. As is known, any visual screening procedure can be made to look good or bad by merely making standards which are too low or too unrealistically high. Then if any of the groups participating in the screening so choose, they can slant that portion that they do not wish to succeed. This is simply done by classing a referral in any category as an over referral.

I am reasonably sure no concerted effort was made in this line on this screening, although our medical colleagues felt that possibly the plus lens test and the phoria tests were over referring a few. The R-1 School Board, however, are not worrying about this small percentage, as they feel they are referring more students in need of examination, which has been their attitude from the first. This attitude, for which they are to be commended, is the real reason for the success of the many ventures upon which they embark.

The standards as set up for passing were as follows:

Part I (Snellen illiterate E.) Kindergarten through Grade 2: Four out of six symbols correct in 20/30 line. Grades 3 through 12: Four out of six symbols correct in 20/20 line.

Part II (plus sphere). Kindergarten through Grade 2: Plus 2.25 sphere and inability to see four out of six symbols in 20/30 line. Grades 3 through 12: Plus 1.50 sphere and inability to see four out of six symbols in 20/20 line.

Part III (Phoria-Maddox Rod). At 6 meters: 4Δ exophoria, or 6Δ esophoria, and 1¼ right or left hyperphoria. At 40 cm.: 7½ Δ exophoria or 6¼ Δ esophoria.

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*Read before the annual meeting of the American Academy of Optometry, Executive Council, Boston, Massachusetts, December 13, 1958. For publication in the March, 1959, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Fellow, American Academy of Optometry.

[1]Otto J. Bebber. A school visual screening program in Colorado. Am. J. Optom. & Arch. Am. Acad. Optom. 35, 2, 79-82, 1958.

Keeping these standards in mind, the following is the statistical analysis of the children screened:

Number screened	13,118
Number referred	1,855—14 %
Referrals returned	589—31.8%
Referrals evaluated (to date)	426
Analysis of referrals 426 completed:	
Referred by screening—	
Failure Part I (Snellen)	340—80 %
Failure Part II (plus sphere)	40— 9.3%
Failure Part III (phoria)	46—10.7%
Validity of referrals:	
Correct referral	390—91.5%
Over referral	36— 8.5%

The writer would not want these figures released without some comment. You will note that 80% were rejected on the Snellen test and they went no further in the examination of this group. Seventeen were over referred. In the plus lens test nine were over referred. In the phoria test 10 were over referred, which means that on just the basis of those referred on these parts, the tests are 75% valid, which, in the first year of the program, we feel is phenomenal.

Since the inception of the screening program, this county has withdrawn from the Tri-County Health District and is now operating its own Health Department. I do not feel this will materially affect the screening program, but it points out the necessity of maintaining the statistics at the school rather than in the Health Board offices, and it should also probably mean that the follow-through should be maintained at this level.

Since the compilation of this data, our professional committee has met and while the meeting was basically to evaluate the statistics compiled, it was evident that our medical colleagues would like to withdraw from this committee as co-workers with the optometrists. We sincerely hope such is not the case, as we feel the public is better served by a meeting of the minds, and we would prefer not to carry on alone, as there would be the possibility of a disservice to the public in an attempt to discredit the screening methods. We, as optometrists, have expressed the desire that it will be possible for our medical colleagues to continue to work on the committee as we attempt to even further improve the quality of the visual screening program.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

ACADEMY MONOGRAPHS

One of the popular educational services offered optometrists by the American Academy of Optometry is the publication and distribution of low cost technical monographs. These specially published reprints deal with a great variety of subjects of interest and value to optometrists.

Each monograph is authored by one or more specialists in the selected subject. Not only is this service popular because of its low cost, it is even more appreciated because of the authoritative positions held in optometric practice by those optometrists and educators who have written the extensive material included in this series of now available monographs. This is a continuing service and the profession already recognizes the conservatism and competence of this large body of clinical and scientific writers.

These educational monographs report studies in various fields of optometric practice. This series is unique in its contribution to the *Science of Seeing*, presenting a body of material covering many aspects of the subject. These monographs represent a type of clinical and scientific material which is indispensable to the optometrist, research worker, educator and to the student of visual problems.

More than 200 different titles offer a very wide selection covering most phases of optometric practice. These 6" x 9" monographs vary in length from 8 to 72 printed pages. Each reprint is bound in heavy board covers for permanence.

These monographs will be mailed, postpaid, to professionally interested persons upon receipt of order accompanied by the cost of the reprint or reprints ordered. Payment with orders is essential. Stamps or coins are acceptable on small orders. In ordering monographs selection should be made by number.

The 1959 listing of available monographs follows. This list supersedes prior published lists and only those monographs now catalogued are offered at this time. See pages 157-165.

Orders and checks should be sent to the American Academy of Optometry, 1508 Foshay Tower, Minneapolis 2, Minn.

RUDOLPH EHRENBERG

Monograph 1-A

☐ *Heterophoria and aniseikona.* Robert E. Bannon. 16 pages + cover. (1939). 40c.

Monograph 1-B

☐ *On the technique of measuring and correcting aniseikonia.* Robert E. Bannon. 20 pages + cover. (1941). 45c.

Monograph 1

☐ *The fitting of contact lenses by the molding technique.* Solon M. Braff. 24 pages + cover. (1944). 50c.

Monograph 5

☐ *Forces behind an industrial vision program.* Richard Feinberg. 8 pages + cover. (1945). 30c.

Monograph 6

☐ *National Registration and reciprocity.* Carel C. Koch. 8 pages + cover. (1945). 30c.

Monograph 9

☐ *Possible effects of public health programs upon optometry.* Carel C. Koch. 8 pages + cover. (1945). 30c.

Monograph 13

☐ *The isotonicity of contact lens solution.* Robert J. Roth. 16 pages + cover. (1946). 40c.

Monograph 16

☐ *Experimental investigation of cyclofusion.* V. J. Ellerbrock. 16 pages + cover. (1946). 40c.

Monograph 18

☐ *Some principles of nomenclature.* Eugene Freeman. 8 pages + cover. (1946). 30c.

Monograph 21

☐ *Theoretical implications of the response of a photoreceptor to a flash of light.* Glenn A. Fry and Mathew Alpern. 20 pages + cover. (1946). 45c.

Monograph 22

☐ *The major reference point in a single vision lens.* Glenn A. Fry. 8 pages + cover. (1947). 30c.

Monograph 24

☐ *Effect of quality of illumination and distance of observation upon performance in the Ishihara test.* David Volk and Glenn A. Fry. 24 pages + cover. (1947). 50c.

Monograph 25

☐ *Absence of accommodation—A case report.* E. E. Reese and H. W. Hofstetter. 8 pages + cover. (1947). 30c.

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Monograph 28

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Monograph 34

☐ *The stereoscope as a method of measuring distance discrimination.* Monroe J. Hirsch. 8 pages + cover. (1947). 30c.

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☐ *Certain variations in the angle of deviation in concomitant squint.* Henry W. Hofstetter. 12 pages + cover. (1947). 35c.

Monograph 39

☐ *Notes on ametropia—A further analysis of Stenstrom's data.* Monroe J. Hirsch and Frank W. Weymouth. 8 pages + cover. (1947). 30c.

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☐ *The basis for failure on color vision tests.* Charles S. Bridgman. 16 pages + cover. (1948). 40c.

Monograph 41

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CURRENT COMMENTS

Terry Judith Parkins
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department: such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

WOMEN IN OPTOMETRY

A niece of mine writes and asks what I think of her planning to go into optometry. She is just 14 and in her first year of high school. So far her grades have been good and her interests seem to lean towards a scientific subject.

It is good to have her letter and I am glad to know that she is thinking of her future and the value of specialized college training, not only to herself but to her associates in the life she has ahead of her.

Apparently she already knows we are living in the age of specialization and those who are properly trained are usually well repaid, both in money and the satisfaction they received from their work.

Optometry is part of this age of specialization and so let us look at the actual work of the optometrist.* In the first place, the optometrist is a part of a vast health team charged with keeping millions of citizens in good health and able to live fine, long, useful lives. The major concern of the optometrist is applying skills and training so that people can use their eyes in complete comfort, both in reading and all near tasks, as well as in giving them excellent distance vision. Because of our high standards of hygiene, our pure food laws and the general good state of health of millions of Americans, there are few persons with treatable eye disease in comparison to the very large number of individuals who require some special help in making them see better or to see with greater comfort. This latter group comprises 65 per cent of the population and here it is that optometrists come in. For a long period now, optometrists have been trained to examine and refract the eyes of patients and to prescribe for those who have visual problems. Many of these prescriptions call for spectacles. Others, though relatively less in number, call for visual training, or in some cases special aids to vision or perhaps the newer types of tiny contact lenses.

The optometrist must be well trained for this chosen field and the optometrist must be the type of person who enjoys meticulous detailed work and also who enjoys having people around him at all times. It is really made-to-order for women. Optometry is truly a

*Excerpts from an answer to niece.

service profession where skilled professional service results in a very high average of satisfied patients.

You ask, "Is this a proper field for a girl to choose for her life's work?" The answer is a definite *yes*. There are many successful women optometrists. I think there are 28 who are Fellows of the American Academy of Optometry. This is about 3 per cent of the membership, and I am told that about 3 per cent of all the 18,000 optometrists in this country are women. Many women optometrists are married and have families, and these optometrists still enjoy the exhilarating experience of a professional practice. If you think you would like health work, I am sure you would enjoy being an optometrist as the work is clean, stimulating and the rewards are what you make them.

In your letter you say your father wants you to go to Wellesley, Vasser or Smith. That is just fine as these are excellent liberal arts colleges where you may get your pre-optometric college credits. If you go to one of these schools by all means stay there the full four years until you get your B.A. degree. Then enroll for your undergraduate professional optometric work in one of the specialized colleges that teach this subject. You will be through your education by the time you are 25 and that's just about the right age for a girl to start an optometric practice of her own.

GETMAN ON CHILDREN'S INTELLIGENCE

We have received from the author the new 6th edition of the monograph *How To Develop Your Child's Intelligence* by Dr. G. N. Getman of Luverne, Minnesota. Dr. Getman says, "I feel the 6th edition is much improved over previous editions in artwork, context, type face and make up. It is being enthusiastically received by optometrists who are using it as a parent's manual, and by teachers in primary grades. I am especially pleased that every mail is bringing orders direct from patients, teachers, elementary supervisors, and librarians."

Essentially this monograph is written for parents and teachers. Optometrists doing visual training work with children will also find it helpful and may wish to have extra copies to loan or give to parents. It is especially written for this purpose.

Earlier this month Dr. Getman spoke before the Southwest Congress in Fort Worth, Texas. At this meeting the general chairman, Dr. Nelson Greeman, Sr., awarded a plaque to Dr. Getman for his original work in developmental vision, and the contribution he has made to children's vision care.

In making the award Dr. Greeman said, "Tonight we are honoring Dr. G. N. Getman. We pay special tribute to him who not only

has made a wonderful contribution to optometry, but to humanity. This man has dedicated his life to the service of mankind through optometry. Modern civilization has brought us many privileges and many advantages, but it has also brought us many problems. For many years in optometry we were engaged in 'patching up' and repairing damage and in providing protection against the impact of the visual task. Now, and as a result of the dedicated efforts of the man we are honoring tonight, we can talk in terms of developmental vision and preventive care. There is no person in this profession who can compare with Dr. Getman in the breadth of knowledge in the new field of developmental vision and preventive care.

"Dr. Getman graduated from Northern Illinois College of Optometry in 1937. He holds the D.O.S. degree from the same college. He was the assisting optometrist at the Yale Clinic of Child Development from 1946 through 1950, and out of this work came the book, *Vision, Its Development in the Infant and Child*. Dr. Getman is a co-author of that book. He was visual clinician in the Child Vision Research Project at Yale University from 1949 to 1954. He is likewise co-author of the Developmental Vision texts issued by the Optometric Extension Program in 1950-51, 1957-58, and the Program's current series of 1958-59. He is the author of the recently published book, *How to Develop Your Child's Intelligence*. He has conducted classes for optometrists in developmental vision in Luverne, Minnesota, and at Purdue University."

The new 6th edition of the Getman monograph *How To Develop Your Child's Intelligence* is available from the author, Dr. G. N. Getman, Luverne, Minnesota. Board covers. 56 pages. $3.50 postage prepaid.

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both with and without spectacles.
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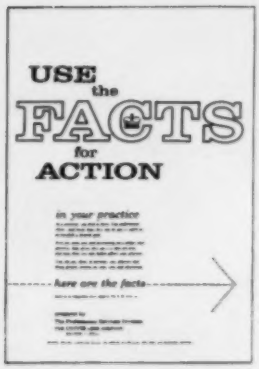

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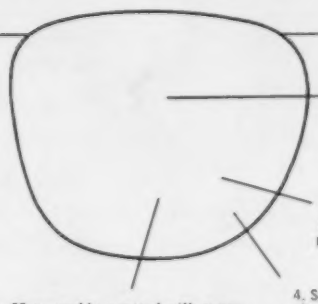

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